

CLAIMS:

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98. A method of producing a genetically modified plant,  
comprising:

- (a) providing at least one plant cell capable of being  
5 transformed and being generated into a whole plant;
- (b) introducing into the at least one plant cell:
  - (i) a repressible lethal gene encoding a gene  
product having an activity lethal to plant cells, and
  - (ii) a repressor gene encoding a gene product  
10 capable of repressing the activity of the gene product of the  
repressible lethal gene;
- (c) generating a plurality of whole plants from the at  
least one plant cell; and
- (d) selecting for a genetically modified plant descended  
15 from or derived from at least one of the plurality of whole  
plants by determining incorporation and mutually independent  
segregation of the repressor gene and the repressible lethal  
gene within the genetically modified plant.

99. The method of claim 98, wherein said introducing  
20 further comprises providing the repressible lethal gene in a  
first vector construct and providing the repressor gene in a  
second vector construct, and further comprising crossing at  
least two plants of the plurality of whole plants prior to said  
selecting.

25 100. The method of claim 99, further comprising providing a  
conditionally lethal gene in the first vector construct, the  
conditionally lethal gene configured for encoding a gene  
product lethal to cells of the genetically modified plant upon

application of a chemical or physiological stress to the genetically modified plant.

101. The method of claim 98, wherein said determining mutually independent segregation of the repressor gene and the repressible lethal gene comprises determining that the repressible lethal gene and the repressor gene are located on respective opposite sister chromosomes of a chromosome pair of a plant cell of the genetically modified plant.

102. The method of claim 98, wherein said introducing comprises providing the repressible lethal gene and the repressor gene as part of a single vector construct, and further comprising

introducing at least one of a recombinase or a transposase having recognition specificity to at least one nucleic acid site of the single vector construct, the recombinase or a transposase configured for effecting the mutually independent segregation of the repressor gene and the repressible lethal gene by transposition or recombination of at least one nucleic acid in the single vector construct.

103. The method of claim 98, further comprising providing a tissue-specific promoter in transcriptional control of at least one of the repressible lethal gene or the repressor gene.

104. The method of claim 103, wherein said providing the tissue-specific promoter comprises providing a seed-specific promoter.

105. The method of claim 104, wherein the seed-specific promoter is a phaseolin promoter.

106. The method of claim 98, further comprising providing an inducible promoter in transcriptional control of the repressor gene.

107. The method of claim 98, further comprising providing a DNA operator sequence in operable association with the repressible lethal gene, the DNA operator sequence adapted for binding the gene product of the repressor gene to repress  
5 transcription of the gene product of the repressible lethal gene.

108. The method of claim 98, wherein the activity of the gene product of the repressible lethal gene comprises over-expression or under-expression of a naturally occurring plant  
10 growth regulating substance in a plant cell of the genetically modified plant.

109. The method of claim 98, wherein the repressible lethal gene is selected from the group consisting of oncogenes 1 and 2, oncogene 4 of *Agrobacterium*, a gene encoding a ribosome  
15 inactivating protein, a gene encoding diphtheria A chain toxin, and a gene encoding a ribonuclease.

110. The method of claim 98, further comprising linking a gene encoding a trait of interest with the repressible lethal gene in a first vector construct, and wherein said introducing  
20 comprises introducing the first vector construct to the at least one plant cell.

111. The method of claim 98, wherein the repressor comprises a repressor selected from the group consisting of an antisense RNA, a ribozyme, and a sense gene.

25 112. The method of claim 98, wherein said generating the plurality of whole plants comprises generating at least one plant which is homozygous for the repressible lethal gene and the repressor gene.

113. The method of claim 112, further comprising crossing the  
30 at least one plant which is homozygous for the repressible

lethal gene and the repressor gene with a second plant to produce the genetically modified plant.

114. A method of producing a genetically modified plant having at least one repressible lethal gene expressed during  
5 outcrossing or introgression of alien germplasm, comprising:

(a) providing a plant cell capable of being transformed and being regenerated to a whole plant;

(b) introducing into the plant cell:

10 (i) a first repressible lethal gene under transcriptional control of a seed-specific promoter, the first repressible lethal gene encoding a gene product having a first gene product activity lethal to plant cells;

(ii) a first operator sequence in operable association with the first repressible lethal gene;

15 (iii) a first bacterial repressor gene, the first bacterial repressor gene encoding a gene product capable of repressing the first gene product activity by binding to the first operator sequence;

20 (iv) a second repressible lethal gene under transcriptional control of a seed-specific promoter, the second repressible lethal gene encoding a gene product having a second gene product activity lethal to said plant cells;

(v) a second operator sequence in operable association with the second repressible lethal gene;

25 (vi) a second repressor gene, the second repressor gene encoding a gene product capable of repressing the second gene product activity by binding to the second operator sequence;

(vii) at least one gene encoding a trait of interest linked to at least one of the first and second repressible lethal genes;

(c) regenerating a whole plant from the plant cell; and

5 (d) selecting for a genetically modified plant descended from or derived from the whole plant by determining incorporation and mutually independent segregation of the first repressor gene from the first repressible lethal gene, and by determining incorporation and mutually independent segregation of the  
10 second repressor gene from the second repressible lethal gene within the genetically modified plant.

115. The method of claim 114, wherein said introducing further comprises providing the first repressible lethal gene, the at least one gene encoding the trait of interest, the first  
15 operator sequence and the second repressor gene in a first genetic construct, and providing the second repressible lethal gene, the second operator sequence and the first repressor gene in a second genetic construct.

116. The method of claim 114, wherein said introducing  
20 comprises introducing the first repressible lethal gene, the first operator sequence, the at least one gene encoding the trait of interest, the second repressor gene, the second repressible lethal gene, the second operator sequence and the first repressor gene to the plant cell in a single  
25 transformation vector.

117. The method of claim 116, further comprising introducing to the plant cell at least one recombinase and/or transposase configured for effecting the mutually independent segregation of the first repressor gene from the first repressible lethal  
30 gene and the mutually independent segregation of the second repressor gene from the second repressible lethal gene by

transposition or recombination of at least one nucleic acid in the single transformation vector.

118. A method of producing a genetically modified plant having at least one repressible lethal gene expressed during  
5 outcrossing or introgression of alien germplasm, comprising:

(a) providing a plant cell capable of being transformed and being regenerated to a whole plant;

(b) introducing into the plant cell:

(i) a first repressible lethal gene under  
10 transcriptional control of a seed-specific promoter, the first repressible lethal gene encoding a gene product having a first gene product activity lethal to plant cells;

(ii) a first operator sequence in operable association with the first repressible lethal gene;

(iii) a first bacterial repressor gene, the first  
15 bacterial repressor gene encoding a gene product capable of repressing the first gene product activity by binding to the first operator sequence;

(iv) at least one gene encoding a trait of interest  
20 linked to the first repressible lethal gene;

(c) regenerating a whole plant from the plant cell; and

(d) selecting for a genetically modified plant descended from or derived from the whole plant by determining incorporation and mutually independent segregation of the first repressor  
25 gene from the first repressible lethal gene.

119. A plant comprising at least one plant cell derived from or descended from a genetically modified plant produced by the method of claim 98, claim 114, or claim 118.